DISSERTATION

on

TO EVALUATE AND ASSESS THE PERSPECTIVE OF RADIOLOGY PROFESSIONAL TOWARDS ARTIFICIAL INTELLIGENCE- THE FUTURE OF RADIOLOGY.

Submitted in partial fulfilment
of the

Requirements for the award of

the degree of

MASTER OF SCIENCE

In

MEDICAL IMAGING TECHNOLOGY

By

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GLOSSARY OF ABBREVIATION

SNO.	FULL FORM	ABBREVIATION
1.	ARTIFICIAL INTELLIGENCE	AI
2.	MACHINE LEARNING	ML
3.	COMPUTED TOMOGRAPHY	CT
4.	MAGNETIC RESONANCE IMAGING	MRI
5.	AS LOW AS REASONABLY ACHIEVABLE	ALARA
6.	DIAGNOSTIC REFERENCE LEVELS	DRL
7.	DOSE LENGTH PRODUCT	DLP
8.	ET ALIBI AND CO WORKER	Et.al
9.	FIGURE	Fig
10.	KILOVOLTAGE PEAK	KVp

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ABSTRACT

Objective: The primary aim of the study is to evaluate and assess the perspective of radiology professional towards artificial intelligence- the future of radiology among various teaching institutes & hospitals in Eastern & Western UP.

Methods: A questionnaire based cross-sectional study is carried out in various teaching institutes & hospitals excluding the candidates who fell under exclusion criteria. A google form was circulated through e-mail and WhatsApp. The data analysis is done through Microsoft Excel (Microsoft® Excel® 2021 MSO (Version 2407 Build 16.0.17830.20056) 64-bit**)**

Results: With a majority anticipating the expansion of specialized positions linked to AI, respondents were generally positive about the future role of AI in radiology. In order to create a creative atmosphere that welcomes technical breakthroughs, this optimism is crucial. Ongoing assessment and improvement of AI applications is necessary to guarantee fair and efficient results, although worries regarding algorithmic bias and decision support systems have also surfaced. With a majority anticipating the expansion of specialized positions linked to AI, respondents were generally positive about the future role of AI in radiology. In order to create a creative atmosphere that welcomes technical breakthroughs, this optimism is crucial. The necessity for continual assessment and improvement of AI applications, however, was highlighted by worries around algorithmic bias and decision support systems.

Conclusions: The survey concludes that radiology professionals have an overall positive attitude towards technology, with a particular enthusiasm for applications using artificial intelligence and machine learning. Although there is a solid base of knowledge and a readiness to use these technologies, there is still room for development in the areas of trust, ethical considerations, and training. To enable the effective integration of AI into clinical practice, it is crucial to give priority to education, transparency, and ethical considerations as the field of radiology continues to change as a result of technological breakthroughs. Future studies may examine how opinions and usage habits evolve over time as AI technology advance and become more commonplace.

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CHAPTER – 1

INTRODUCTION

The medical world considers artificial intelligence (AI) the "stethoscope of the 21st century" owing to its significant effect on the field's future [1]. Radiology is a branch that is inextricably linked to electronics and reliant on computers, and as a result, it has undergone almost continuous development in the area of medical research in comparison to other medical specialties. AI has quickly developed into an extremely revolutionary discipline in the field of radiation sciences. Researchers describe AI as devices that can execute human-like activities using computational techniques. AI is a computer program or machine's capacity to think and develop capable of creative solutions. Within the scope of radiology, artificial intelligence could profoundly impact the field as a potentially useful clinical method [2]. AI is expected to revolutionize in the coming decades. One of the disciplines that will be significantly influenced by the emergence of AI is radiology.

X-rays discovery was not a development but the result of an accident. During the years 1890-1895, European physicist Heinrich Hertz experimented with cathode rays generated in Crooke's tube. Hertz demonstrated that x rays could travel through a thin aluminium foil contained inside the tube and concluded that cathode rays are waves, not particles. One of Hertz's assistants, Philip Lenard, changed the x-ray tube such that an aluminium foil window was present, and found that rays could appear from the window and be observed a few inches away. These rays were given the name Lenard rays. A great enthusiasm was inspired by Lenard's research, which then contributed to the undertaking of the final experiment of November 8th 1895 on Friday afternoon by Wilhelm Conrad Roentgen, the discoverer of X-rays. When it came to light, Sir Roentgen was a 50-year-old physics professor at the Wurzburg University in Germany. Sir performed his experiment in a totally darkened space using Crooke's tube, which was wrapped in a lightproof cardboard jacket coated in black photographic paper to aid in visualizing the cathode rays' impact within the tube. A few meters away from the Crooke's tube was a plate covered with barium platinocyanide, a fluorescent substance. While conducting the experiment, he was surprised to see that the barium platinocyanide plate was glowing. He repeated the experiment by moving the plate closer and farther and found that fluorescence only happens within six and seven feet of separation from the cathode because of the cathode rays not being able to go that far.

Following a careful investigation, he concluded that this was something new; it wasn't visible light or cathode rays. The plate scintillation came with a new kind of radiation called X and was surprised to learn that the rays were able to go through the cardboard. The findings were shocking, since the bones of the hand were easily visible while a hand was held between the Crooke's tube and fluorescent plate. On 22 December 1895, a famous skiagram (the first radiograph) of Roentgen's wife's hand was made. Roentgen earned the first Noble Prize in Physics in 1901 for discovering Roentgen rays, which he coined the term "X rays" [3].

1.1 THE PLAIN FILM RADIOGRAPHY

In the early years, the plain film radiography was used, but it suffered due to the low strength of the apparatus, which made it impossible to see across the thicker areas of the body. As a result, fluoroscopy was determined to be most suitable for examinations of the chest and other thicker areas of the body. The cryptoscope, a straightforward fluorescent tube, was used until the 1940s, when it eventually ceased to be used. When Wilhelm Roentgen discovered x-rays in 1895, he identified their results on a fluorescent screen as well as on photographic glass, resulting in the terms radiography and fluoroscopy [3].

By 1897, the negative results of x-rays, including hair loss and skin burns, began to be widely recognized. Afterwards, harmful events were investigated, and protective devices were added. Throughout the early decades of the "20th century", a few individuals thought that x-rays could be applied to discern human emotions. Early in the 20th century, researchers used bismuth, a radiopaque dye, to examine the gastrointestinal tract. X-rays were initially utilized for evaluating bones and for the purpose of locating large things like stones and foreign bodies. With developments in x-ray technology, it is now possible to photograph delicate tissues with x-rays, including breast tissue. Mammography has now developed into a vital technique for the detection of breast cancer. The use of x-rays to treat cancer is a noteworthy development in radiology and is categorized as radiation oncology or radiotherapy [3].

1.2 EXPANSION OF MEDICAL IMAGING MODALITIES

Radiology as a field underwent a fundamental change with the inclusion of ultrasound, "computed tomography (CT)", and "magnetic resonance imaging (MRI)" in clinical practice throughout the latter half of the 20th century.

Ultrasound – Lazzaro Spallanzani, an Italian biologist is being credited for the discovery of ultrasonography [4]. It was first used clinically in the 1940s. The non-ionizing radiation-based medical imaging device allows photographs that encompass nearly the whole body, particularly the growing embryo inside the mother. Most significant uses of ultrasound or Sonography were the visualization of the development of the foetus within the mother's womb. The primary benefit is that it can be used at the bedside of the patient [5]. Ultrasound examination is less expensive as compared to CT and MRI. The biggest advancement in diagnostic ultrasound was the invention of the real-time scanner, which revolutionized ultrasound practice. Ultrasound's spectrum steadily expanded and was having a noticeable influence on clinical practice. Ultrasound devices have been smaller and more lightweight in recent years. Ultrasound devices as small as smart phones are now accessible. FAST (Focused Abdominal Sonography in Trauma) is now routinely used to diagnose chest and abdominal anatomy during the initial evaluation phase. The development of ultrasonography is moving with a great pace from compact, portable machines to hybrid imaging. The practical application of artificial intelligenceinto clinical practice expands future advantages of ultrasound. Ultrasound AI software must operate in a manner distinct from CT AI software. AI is capable to meet the needs of different tasks of ultrasonography [6].

Figure 1.1: Toshiba’s Aplio 500 ultrasound equipment

Computed Tomography (CT) – Godfrey Hounsfield, British Engineer of EMI laboratories introduced first commercial CT scanner [7]. It was introduced into clinical practice during 1970s in the United Kingdom. Initially, It was confined to head imaging, but as science developed, imaging facilities for the whole body became accessible. The CT scan creates cross-sectional pictures of the body using x-rays. The primary benefit is its efficiency, as new generation CT scanners can image huge body parts in a matter of seconds [5]. CT scan technology enables physicians to envision almost any aspect of a patient's anatomy and correctly detect illness. It is important in preparing a patient's treatment, whether surgical, medical, or radiation. CT scans have progressed rapidly since the day it was introduced and evolved into the most valuable tool. An innovative change in the way of thinking with respect to diagnosis and care was enabled using a CT scanner. The new developments in CT have increased its use and replaced conventional imaging techniques. Hybrid imaging (SPECT-CT) is now being created by combining CT with additional imaging techniques including "positron emission tomography (PET-CT)" and the "single photon emission computed tomography". Radiologists and radiographers throughout the world recognize the introduction and development with artificial intelligence in the field of medical diagnosis as a boon. The latest study of CT revealed that AI is capable to scan CT images within 1.2 seconds and is able to diagnose and identify the ailment quicker than human radiologists [7].

Figure 1.2: Deep learning based CT image reconstruction

Magnetic Resonance Imaging (MRI) – Initially MRI was called "magnetic resonance imaging (NMR)". "Felix Bloch and Edward Mills Purcell" discovered nuclear magnetic resonance after the Second World War [8]. It was first used clinically in the 1980s. MRI provides non-invasive tools to investigate the internal anatomy and physiology of living objects [9]. It is a sophisticated imaging modality that provides excellent resolution to various body structures. It possesses the key advantage of not using harmful ionizing radiation [5]. MRI continued to develop rapidly with higher magnetic field strength of magnets and improved techniques. At the dawn of the twenty-first century, open scanners for claustrophobic patients and scanners with much stronger magnetic fields emerged. Advances in cardiac imaging, as well as intervention have been revolutionized by magnetic resonance imaging (MRI). AI has tremendously exploded in the field of MRI in recent years. Deep learning methods promise approaches apply when reconstructing under sampled MRI data and when low-quality images are available [10].

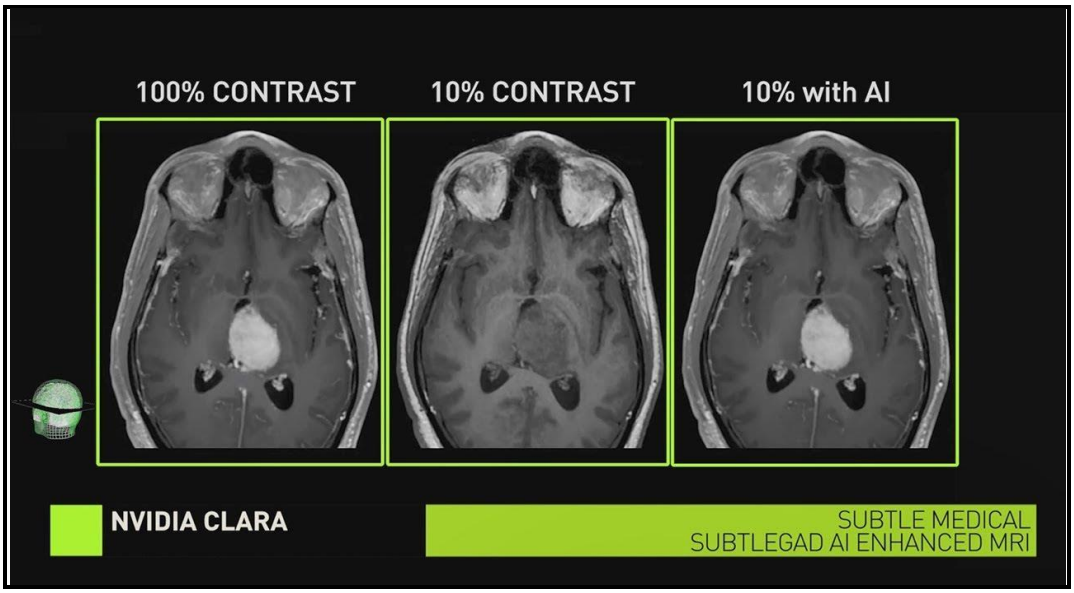


Figure 1.3: Subtle gadolinium AI enhanced MRI

1.3 Artificial Intelligence

Artificial Intelligence will bring changes to the professional life of radiologists as well as to the life of radiographers in the similar way as it has modified other aspects of human lives. Artificial intelligence (AI) is a term which applies to the algorithms that allow computers to conduct tasks that require human cognitive ability, such as vision interpretation, speech recognition, and decision making. Despite the idea of artificial intelligence in medical

imaging initially came up in the 1960s, rapid advancement was not possible at the time due to a lack of technological modifications [11]. AI is composed of two components: machine learning (ML) and the convolutional neural networks influenced by the brain (CNN). AI incorporates machine learning, and machine learning encompasses deep learning. The field of machine learning is an aspect of artificial intelligence that focuses on constructing computer algorithms that do not formally represent decision-making concepts. Deep learning, also known as deep convolutional neural networks or CNNs, is a branch of supervised machine learning that has garnered the most attention in recent years. Deep neural networks are a subset of supervised learning that makes use of an algorithmic architecture focused on multilayer neural networks [12].

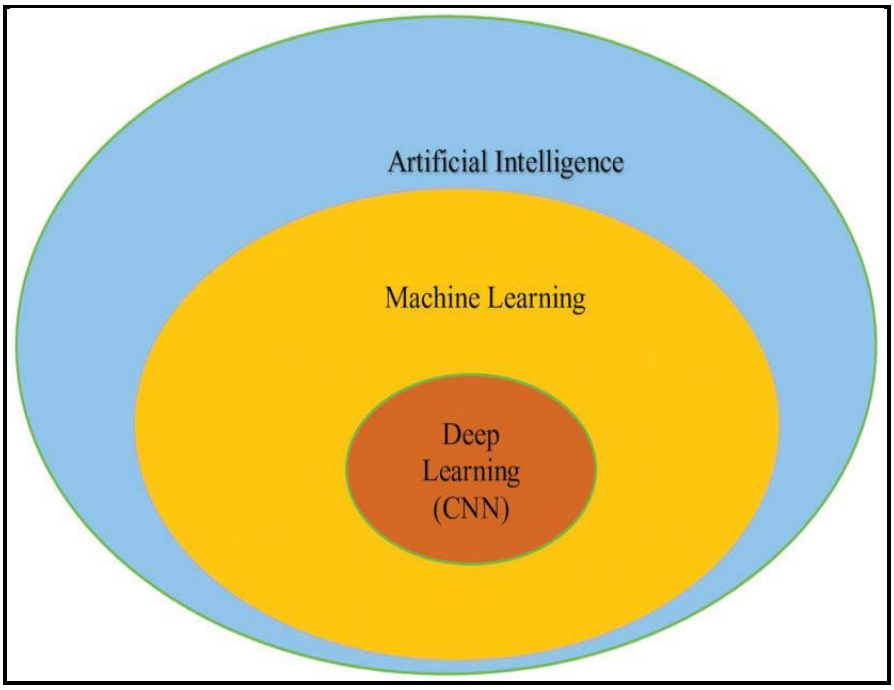


Figure 1.4: Artificial Intelligence

Artificial intelligence involves the research and development of computer systems that can execute tasks that usually demand human intelligence. In recent years, proposed AI technologies for diagnostic imaging have increased significantly both in academia and professionally. Radiographers have long welcomed automated technology into their work, which others believe has resulted in a loss of fundamental knowledge, roles, and capacity for autonomous decision-making. Radiology has always been the entry point for medical scientific advances, and AI is unlikely to be any different [12]. AI is capable of affecting the workflow in the radiology department. AI algorithms may be used at the point of treatment to

assist physicians in making imaging decisions, not only by evaluating a patient's medical background and determining whether imaging is required, but also by deciding on the most suitable imaging exam [12].

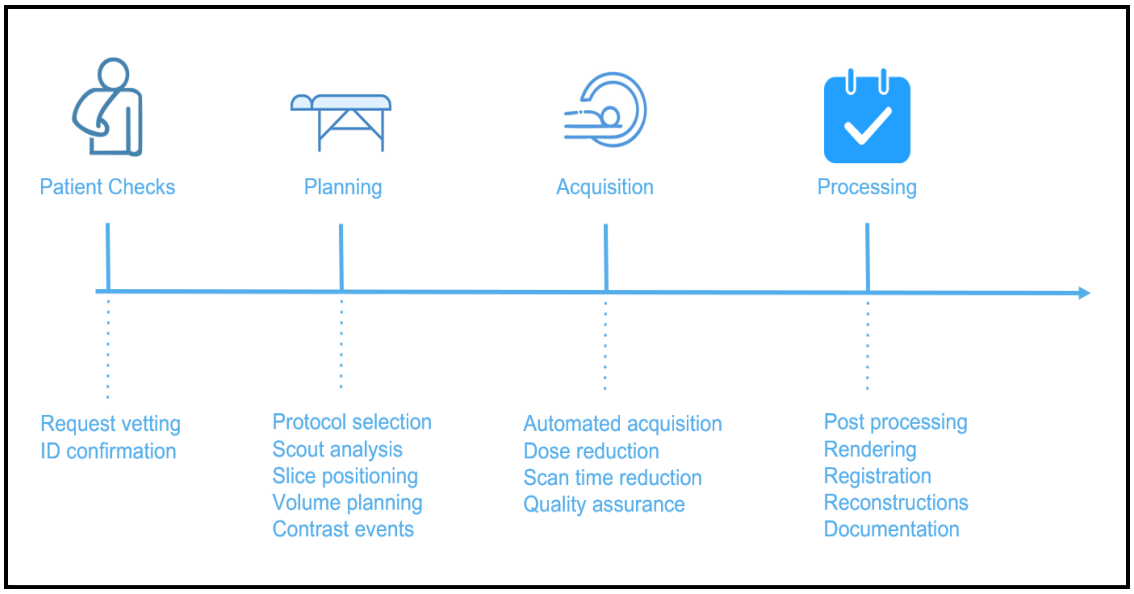


Figure 1.5: Areas where AI is expected to have an impact on cross-sectional radiography workflow

1.4 Use of AI in Radiography

Artificial intelligence should be utilized in clinical practice only after it has been tested and shown to benefit patients by testing. Radiologists and Radiologists should use AI for clinical decision support to identify what imaging examinations are required to assist in their clinical decisions. Additionally, radiographers have the ability to play a greater part in speaking to patients on the perceived benefit/risk of radiation dose while justifying experiments, and will require an intensive morning and advice from specialist practitioners. To maximize the roles of radiographers and radiologic technologists, AI-assisted picture analysis of x-rays can enable them to provide findings to patients that are applicable and applied, quickly. Radiographers and radiological technologists employed in the field of radiation therapy can use artificial intelligence (AI) to enhance scheduling, have reliable, high-quality, and personalized patient and radiation therapy treatment planning procedures, such as recognizing at-risk organ(s), segmenting tumours, image matching, and dose stratification[14]. Since the ability of AI is much greater than that of a human radiographer, it allows radiologists to work

faster and more productively. AI devices could be able to simplify iso centric positioning and scout image processing during CT, as well as MR plane and volume measurements. Intelligent devices may also be used to optimize contrast volume and injection speeds depending on patient criteria. Deep learning algorithms can also be used in the field of clinical preparation and therapeutic radiography to schedule treatment regions, eventually improving patient safety and reducing unexpected treatment effects. With standardization, it is likely that protocols will be selected through computer algorithms. Additionally, there are a slew of AI-driven dose reduction strategies for mammography, CT, and MR time reduction, both of which result in quicker image retrieval. Newer AI systems will be able to perform post processing techniques at much higher speed, allowing for image super-resolution [15].

1.5 Impact of AI on Radiographic Practice

In general, artificial intelligence has long been included into image technologies. The first example of artificial intelligence being utilized in everyday radiography work was the "Automatic Exposure Device (AED)", which was developed in the "1980s". Since modern AI technologies have the ability to simplify a greater range of more complex cognitive abilities, it may be suggested that greater caution and proof should be expected before implementation. When current practices for cross-sectional imaging are contrasted with proposed ways of operating automated imaging devices, it is clear that the task of a radiographer would expand significantly. This would result in the downfall of radiographer's roles and responsibilities. The radiography career now faces a new challenge, as they must learn to work with and supervise AI-driven semi-automated systems [15]. The effect of AI on the workflow would most likely be incremental. Software can include data that we can't get from the images, prioritize examinations based on disease seriousness and eventually becoming part of the routine [15].

CHAPTER – 2

AIM & OBJECTIVE

2.1 AIM

The aim of the study is to evaluate and assess the perspective of radiology professional towards artificial intelligence- the future of radiology.

2.2OBJECTIVES

- To assess the knowledge and understanding of AI technologies among radiology professionals.
- To assess the impact of AI on jobs, roles & responsibilities.
- To identify the main concern and barriers for adoption of AI in radiology

2.3NEED OF STUDY

Our study is to assess knowledge of the radiology professionals about artificial intelligence in the radiology field. Also, this study highlights the need of the hour to impart the learning of artificial intelligence in the curriculum.

CHAPTER – 3

REVIEW OF LITERATURE

***3.1*Shimada et al. (2024)**had studied "**Artificial intelligence-assisted interventions for perioperative anaesthetic management: a systematic review and meta-analysis"** In this systematic analysis, eight randomized controlled studies involving 568 patients were incorporated. Of these, 286 and 282 patients underwent anaesthetic treatment with AI-assisted interventions, respectively. The studies used AI-assisted therapies such as the Hypotension Prediction Index (seven studies; adding only one indicator) and fuzzy logic control for gas concentrations (one research). A meta-analysis comprising the study with the largest sample size (n = 213) revealed no difference in a hypotension-related outcome (mean difference of the time-weighted average of the area under the threshold 0.22, 95% confidence interval -0.03 to 0.48, P = 0.215, I2 93.8%) despite seven studies having small sample sizes (n = 30 to 68, except for the largest). Randomized controlled studies on AI-assisted therapies in anaesthesiology were the subject of this systematic review and meta-analysis.

3.2 **Pinto-Coelho et al. (2023)** studied **"How Artificial Intelligence Is Shaping Medical Imaging Technology: A Survey of Innovations and Applications"**The integration of artificial intelligence (AI) into medical imaging has guided in an era of transformation in healthcare. This literature review explores the latest innovations and applications of AI in the field, highlighting its profound impact on medical diagnosis and patient care. The innovation segment explores cutting-edge developments in AI, such as deep learning algorithms, convolutional neural networks, and generative adversarial networks, which have significantly improved the accuracy and efficiency of medical image analysis. These innovations have enabled rapid and accurate detection of abnormalities, from identifying tumors during radiological examinations to detecting early signs of eye disease in retinal images. The article also highlights various applications of AI in medical imaging, including radiology, pathology, cardiology, and more. AI-based diagnostic tools not only speed up the interpretation of complex images but also improve early detection of disease, ultimately delivering better outcomes for patients.

***3.3*Jha Nisha et al. (2022)** did a study entitled **"Undergraduate Medical Students' and Interns' Knowledge and Perception of Artificial Intelligence in Medicine"**The authors of this study collected responses from interns and students at KIST Medical College in Nepal using a previously validated Canadian questionnaire. A total of 216 students participated. Students in their last year and those with more AI training scored higher. More than 49% agreed or strongly agreed that AI will result in fewer jobs for physicians. The author concluded that students at Nepalese medical schools are ignorant about the effects of artificial intelligence (AI) on both individual patients and the healthcare system as a whole since these topics are not taught in the curriculum.

***3.4*Teng Minnie et al. (2022)** had conducted a survey on **"Health Care Students' Perspectives on Artificial Intelligence: Countrywide Survey in Canada"**

The survey's development began with a narrative literature analysis covering subjects found in AI attitudinal surveys. There were fifteen items in the final poll, consisting of multiple-choice, pick-group-rank, slider scale, 11-point Likert scale, and narrative questions.

It was found that present literature on health care students' perceptions of AI, their preferred methods of learning, and their self-identified knowledge gaps is enhanced by this study. Although many of them felt ignorant about the subject, Canadian health care students were cautiously hopeful about the role of AI in their areas. distinct programs' health care students reported distinct curriculum needs, and these program-specific demands should be considered when integrating AI into the curriculum. The results of this nationwide study will improve education for a variety of health care professions and help us discover the gaps in students' knowledge about AI.

***3.5*Coppola F et al. (2021)** did a study entitled **"Artificial intelligence: radiologists' expectations and opinions gleaned from a nationwide online survey"** Researcher gave thirteen questions to all participants concerning the demographics, their views on AI generally, and the perceived benefits and problems of implementing AI in radiological practice. The survey was completed by 1032 radiologists in total, or 9.5% of SIRM members who were active in 2019. It was discovered that radiologists generally had a good view on the use of AI in their daily job. They were more worried that AI may damage their reputation as professionals than that it would replace them.

***3.6*Huisman M et al. (2021)**did a study entitled **"An international survey on AI in radiology in 1,041 radiologists and radiology residents' part 1: fear of replacement, knowledge and attitude"** in European countries working in an academic centre. Radiologists and residents had access to a poll on AI knowledge, attitudes, and fear of replacement between April and July 2019. Distribution of the survey took place via social media, author networks, and several radiological societies. Using multivariable logistic regression, independent variables of both a favourable attitude toward AI and a fear of replacement were evaluated. According to the study, radiologists and residents with limited knowledge of AI are more likely to be afraid, but those with intermediate to advanced expertise are more likely to have a positive outlook on AI. Thus, more training could enhance clinical adoption.

***3.7* C Ou et al. (2021)** studied **"Deep learning in breast radiology: current progress and future directions"** This review provides an overview of current applications of deep learning methods within breast radiology. The diagnostic capabilities of deep learning in breast radiology continue to improve, giving rise to the prospect that these methods may be integrated not only into detection and classification of breast lesions, but also into areas such as risk estimation and prediction of tumor responses to therapy. Remaining challenges include limited availability of high-quality data with expert annotations and ground truth determinations, the need for further validation of initial results, and unresolved medicolegal considerations.

***3.8*Botwe et al. (2021)** had conducted an online survey to assess "**Radiographers' Perspectives on the Emerging Integration of Artificial Intelligence into Diagnostic Imaging: The Ghana Study"** The authors conducted 3-month survey using a questionnaire among registered 234 Ghanaian radiographers. The questionnaire contained demographics, attitudinal viewpoints on clinical application of AI, perspectives on impact of AI on medical imaging, hypothetical AI implementation challenges, decision making in the face of AI, and a free text/open replies option for extra discussion. The study found that radiographers are optimistic about AI's future in medical imaging, and that challenges to AI deployment in Ghana include a lack of knowledge/technical skills, expensive equipment prices, and cyber dangers. To eradicate this AI should be taken seriously as a part of education structure of radiographers to start practical use of AI in more efficient way.

***3.9*Grainger et al. (2021)** studied **"Learning technologies: A medium for the transformation of medical education?"**The purpose of this is to offer a contextualized examination of factors relevant to teaching staff members' use of learning technology. We contextualize a framework to comprehend how medical education has adopted learning technology in higher education. We find several precursors that indicate individual adoption tendencies, providing insight into aspects of the technology, the staff member responsible for adoption, and the workplace. We provide conceptual clarity to the complex problem of learning technology adoption and evidence to support the claim that learning technologies do not provide a simple path to the radical change of medical education, despite their highly publicized potential.

***3.10*Titano et al. (2021)** studied **"Automated deep-neural-network surveillance of cranial images for acute neurologic events"** Time is brain when it comes to preserving neurologic function and attaining favorable outcomes in acute neurological disorders such stroke, bleeding, and hydrocephalus. Rapid imaging is essential for the identification of many illnesses, even though their symptoms are frequently identifiable.1-6–10. The potential for computer-aided surveillance of acute neurologic events in cranial imaging to triage radiology workflow can reduce treatment time and improve results. While a significant amount of technical effort in volumetric image analysis has been on segmentation, much clinical work has concentrated on computer-assisted diagnosis (CAD). For supervised classification on 3D modeling and light detection and ranging (LiDAR) data, 3D convolutional neural networks (3D-CNNs) have been employed mainly11–15. Here, we provide a weakly supervised classification to screen head using a 3D-CNN architecture.

***3.11*Jindal and Bansalet al. (2020)** had studied "**Knowledge and Education about Artificial Intelligence among Medical Students from Teaching Institutions of India: A Brief Survey"** In the questionnaire-based study, the authors included 226 respondents from three teaching institutions: "Government Medical College and Hospital, Chandigarh, the All-India Institute of Medical Sciences, New Delhi, and Bhopal", comprising 115 males and 111 girls with a median age of 20. The questionnaire consisted of ten questions designed to measure artificial intelligence and computer language expertise. There was no significant difference noted in the responses acquired from boys and girls. The authors found that while medical students are unaware of AI and its applications, they are motivated to learn more about AI and computer programming. AI should be introduced in the medical curriculum as

soon as feasible, according to the necessity of the hour.

***3.12*Pakdemirliet al. (2019)** reviewed "**Artificial Intelligence in Radiology: Friend or Foe? Where are We Now and Where Are We Heading"** The author had discussed about description of AI, evolution of radiology, present and future directions of AI, AI publications, strength and weakness of AI. The study concluded that despite some concerns about the application of AI in radiology, AI looks to be a potential supplemental tool for diagnosis, and triaging looks to be a dependable, hardworking companion to radiology rather than a threat. In the future, AI should be integrated in the radiology curriculum.

***3.13*Ongena et al. (2019)** studied "**Patients' Views on the Implementation of Artificial Intelligence in Radiology: Development and Validation of Standard Questionnaire"**in Netherlands. Six core domains of patient's perspectives on AI in radiology were established by the authors based on the interviews: a technological proof, procedural knowledge, proficiency, performance, responsibility and personal interaction. According to the survey, it was found that patients are generally pessimistic regarding diagnosis done by AI algorithms. Patients also expressed a wish to understand all aspects of the diagnostic procedure. The research resulted in a questionnaire that can be used to assess patient acceptance of AI in radiology.

***3.14 Topol* et al. (2019)**had studied "**High-performance medicine: the convergence of human and artificial intelligence"** The utilization of labelled large data, together with significantly increased processing power and cloud storage, has made artificial intelligence—and the deep-learning subtype in particular—possible in all fields. This is starting to affect medicine on three fronts: first, by allowing physicians to interpret images quickly and accurately; second, by enhancing workflow and potentially lowering medical errors in health systems; and third, by empowering patients to handle their own data to improve their own health. This essay will address the applications' present limitations—such as prejudice, privacy and security concerns, and a lack of transparency—as well as their potential future paths. Significant gains in productivity, accuracy, and workflow will probably materialize over time, but it's unclear whether such gains will be put to use.

***3.15*Park et al. (2019)** had reviewed "**What Should Medical Students Know About Artificial Intelligence in Medicine"**The authors had studied about various prospects related to AI in the field of medicine such as hierarchy of AI, what good changes AI will bring, most

affected sector of medicine, and how students should be prepared for AI. The study concluded that AI is expected to have a significant impact on a variety of areas in medicine, and if correctly planned and implemented, it has the potential to exacerbate many flaws in medical practice while also improving many facets of healthcare. To prepare for the era of AI in medicine, medical students should have proper knowledge about AI, as well as the ability to produce trustworthy information for patients and general public.

3.16 **Saba et al. (2019)** studied **"The present and future of deep learning in radiology"**
The advent of Deep Learning (DL) is poised to dramatically change the delivery of healthcare in the near future. Not only has DL profoundly affected the healthcare industry it has also influenced global businesses. Within a span of very few years, advances such as self-driving cars, robots performing jobs that are hazardous to human, and chat bots talking with human operators have proved that DL has already made large impact on our lives. The open source nature of DL and decreasing prices of computer hardware will further propel such changes. In healthcare, the potential is immense due to the need to automate the processes and evolve error free paradigms. The sheer quantum of DL publications in healthcare has surpassed other domains growing at a very fast pace, particular in radiology. It is therefore imperative for the radiologists to learn about DL and how it differs from other approaches of Artificial Intelligence (AI).

3.17 **Hardy and Harvey et al. (2019)** had studied "**Artificial Intelligence in Diagnostic Imaging-Impact on the Radiography Profession"** The authors assessed existing workflow and cross-mapped prospective areas such as procedure planning, image acquisition, and processing in their review paper to examine the potential influence of AI on the radiography profession. The benefits of AI such as improved patient care, enhanced multi-modality learning, increased technical competence and the extension of radiographer responsibility into AI assisted image reporting were also discussed. The study came to the conclusion that there are options for more authority for professionals, but only if radiologists take the first step in deciding how they want to operate in a world with AI assistance.

3.18 **Nnajiuba et al. (2019)** studied about "**Artificial Intelligence inRadiology: An Assessment of Trainee Perceptions and Understanding"**The objective was to assess the attitude of trainees towards the employment of AI in radiology in UK. The authors conducted a questionnaire-based study among the total of 275 trainees, out of which only 97 actively participated and responded to the questionnaire. The questionnaire was divided into 3 main

sections: to assess understanding of current capabilities, to assess perceptions towards AI, to assess how AI was influencing trainee's future career decisions. The authors concluded that there was a positive attitude of trainees towards the adoption of AI in the radiology field although complete understanding of AI was lacking among the trainee radiologist. Trainee participation would help to promote positive behaviours, ensuring that this technology is embraced and used to its full potential to support patients.

3.19 **Ooi et al. (2019)** studied "**Attitudes towards Artificial Intelligence in Radiology with Learner Needs Assessment within Radiology Residency Programmes: A National Multi-Programme Survey"**The opinions of faculty radiologists and residents in radiology upon artificial intelligence (AI) and machine learning (ML) in radiology, as well as the prerequisites for their learning, were examined by the authors through a survey. A total of 125 participants from Singapore actively participated in the web-based questionnaire among which 86 were male, 39 were female constituting 70 residents and 55 faculty radiologists. The result varied for each, and every question attempted by the respondents. The authors concluded that in the present there is a need for inclusion of AI/ML in curriculum radiology. The knowledge of AI/ML in the curriculum will prepare the radiologists for the future.

3.20 **McBee et al. (2018)** studied **"Deep Learning in Radiology"** As radiology is inherently a data-driven specialty, it is especially conducive to utilizing data processing techniques. One such technique, deep learning (DL), has become a remarkably powerful tool for image processing in recent years. In this work, the Association of University Radiologists Radiology Research Alliance Task Force on Deep Learning provides an overview of DL for the radiologist. This article aims to present an overview of DL in a manner that is understandable to radiologists; to examine past, present, and future applications; as well as to evaluate how radiologists may benefit from this remarkable new tool. We describe several areas within radiology in which DL techniques are having the most significant impact: lesion or disease detection, classification, quantification, and segmentation.

3.21 **Syed et al. (2018)** studied "**Artificial Intelligence in Radiology: Current Technology and Future Directions"** Artificial intelligence (AI) has been hailed as a game-changer for numerous areas, including healthcare, and as the next big thing in the computing revolution. The promise of artificial intelligence and its ability to upend radiologists' practices are causing both great enthusiasm and fear in the field of radiology. AI is probably going to be another medical technology that opens doors, just like radiology has in the past. We review

the recent literature, give a quick summary of the AI developments that have sparked attention, and look at the most likely ways that AI will impact radiology in the years to come.

3.22 **Choy et al. (2018)** studied**"Current Applications and Future Impact of Machine Learning in Radiology"** Promising applications in medical imaging are provided by recent and future developments in machine learning algorithms. The radiology workflow can be enhanced by machine learning in a number of ways, including order scheduling and triage, clinical decision support systems, finding detection and interpretation, post processing and dosage estimate, quality control of examinations, and radiology reporting. The writers of this paper examine modern diagnostic radiology uses of artificial intelligence and machine learning methods. Furthermore, mentioned are the techniques' natural expansion and future significance in radiology practice.

3.23 **Hosny et al. (2018)** studied **"Artificial intelligence in radiology"** Deep learning algorithms, in particular, have shown impressive advancements in picture identification tasks using artificial intelligence (AI). The subject of medical image analysis is advancing quickly thanks to the numerous uses of techniques like variation auto encoders and convolutional neural networks. In the past, radiology practitioners used visual evaluation of medical pictures to identify, characterize, and track diseases. Artificial intelligence techniques are particularly good at automatically identifying intricate patterns in imaging data and producing quantitative evaluations of radiographic features as opposed to qualitative ones. We lay out a general knowledge of AI techniques in this Opinion piece, especially as they relate to image-based applications.

3.24 **Peijun Hu et al. (2017)** studied **"Automatic abdominal multi-organ segmentation using deep convolutional neural network and time-implicit level sets"** The proposed method employs deep fully convolutional neural networks (CNNs) for organ detection and segmentation, which is further refined by a time-implicit multi-phase evolution method. Firstly, a 3D CNN is trained to automatically localize and delineate the organs of interest with a probability prediction map. The learned probability map provides both subject-specific spatial priors and initialization for subsequent fine segmentation. Then, for the refinement of the multi-organ segmentation, image intensity models, probability priors as well as a disjoint region constraint are incorporated into an unified energy functional. Finally, a novel time-implicit multi-phase level-set algorithm is utilized to efficiently optimize the proposed energy functional model.

3.25 **Moravčík et al. (2017)**studied **"Deep Stack: Expert-level artificial intelligence in heads-up no-limit poker"**Artificial intelligence has seen several breakthroughs in recent years, with games often serving as milestones. A common feature of these games is that players have perfect information. Poker, the quintessential game of imperfect information, is a long-standing challenge problem in artificial intelligence. We introduce Deep Stack, an algorithm for imperfect-information settings. It combines recursive reasoning to handle information asymmetry, decomposition to focus computation on the relevant decision, and a form of intuition that is automatically learned from self-play using deep learning. In a study involving 44,000 hands of poker, Deep Stack defeated, with statistical significance, professional poker players in heads-up no-limit Texas hold'em. The approach is theoretically sound and is shown to produce strategies that are more difficult to exploit than prior approaches.

3.26 **Erickson et al. (2017)** studied **"Machine Learning for Medical Imaging"**Machine learning is a technique for recognizing patterns that can be applied to medical images. Although it is a powerful tool that can help in rendering medical diagnoses, it can be misapplied. Machine learning typically begins with the machine learning algorithm system computing the image features that are believed to be of importance in making the prediction or diagnosis of interest. The machine learning algorithm system then identifies the best combination of these image features for classifying the image or computing some metric for the given image region. There are several methods that can be used, each with different strengths and weaknesses. There are open-source versions of most of these machine learning methods that make them easy to try and apply to images. Several metrics for measuring the performance of an algorithm exist; however, one must be aware of the possible associated pitfalls that can result in misleading metrics. More recently, deep learning has started to be used; this method has the benefit that it does not require image feature identification and calculation as a first step; rather, features are identified as part of the learning process. Machine learning has been used in medical imaging and will have a greater influence in the future.

3.27 **Silver et al. (2016)** had studied **" Mastering the game of Go with deep neural networks and tree search"**Because of its vast search space and the difficulty of assessing board situations and moves, go has long been considered the most difficult classic game for artificial intelligence. Here, we provide a novel strategy for playing computer go that

selectsmoves using "policy networks" and evaluates board positions using "value networks." A innovative combination of reinforcement learning from self-play games and supervised learning from human expert games is used to train these deep neural networks. The neural networks play Go at the same level as the most advanced Monte Carlo tree search programs, which simulate thousands of random games of self-play, without using any look ahead search.

3.28 **Gulshan et al. (2016)**had study **"Development and Validation of a Deep Learning Algorithm for Detection of Diabetic Retinopathy in Retinal Fundus Photographs"** A specific type of neural network optimized for image classification called a deep convolutional neural network was trained using a retrospective development data set of 128 175 retinal images, which were graded 3 to 7 times for diabetic retinopathy, diabetic macular edema, and image gradability by a panel of 54 US licensed ophthalmologists and ophthalmology senior residents between May and December 2015. In this evaluation of retinal fundus photographs from adults with diabetes, an algorithm based on deep machine learning had high sensitivity and specificity for detecting referable diabetic retinopathy. Further research is necessary to determine the feasibility of applying this algorithm in the clinical setting and to determine whether use of the algorithm could lead to improved care and outcomes compared with current ophthalmologic assessment.

3.29 **Henglin et al. (2016)** studied **"Machine Learning Approaches in Cardiovascular Imaging"**Cardiovascular imaging technologies continue to increase in their capacity to capture and store large quantities of data. Modern computational methods, developed in the field of machine learning, offer new approaches to leveraging the growing volume of imaging data available for analyses. Machine learning methods can now address data-related problems ranging from simple analytic queries of existing measurement data to the more complex challenges involved in analyzing raw images. Most cardiovascular imaging studies have focused on task-oriented problems, but more studies involving algorithms aimed at generating new clinical insights are emerging. Continued expansion in the size and dimensionality of cardiovascular imaging databases is driving strong interest in applying powerful deep learning methods, in particular, to analyze these data. Overall, the most effective approaches will require an investment in the resources needed to appropriately prepare such large data sets for analyses.

3.30 **Lambin et al (2012)** studied **"Radiomics: extracting more information from medical images using advanced feature analysis"**Solid cancers are spatially and temporally heterogeneous. This limits the use of invasive biopsy based molecular assays but gives huge potential for medical imaging, which has the ability to capture intra-tumoural heterogeneity in a non-invasive way. During the past decades, medical imaging innovations with new hardware, new imaging agents and standardised protocols, allows the field to move towards quantitative imaging. Therefore, also the development of automated and reproducible analysis methodologies to extract more information from image-based features is a requirement. Radiomics--the high-throughput extraction of large amounts of image features from radiographic images--addresses this problem and is one of the approaches that hold great promises but need further validation in multi-centric settings and in the laboratory.

CHAPTER – 4

MATERIALS &METHODOLOGY

4.1 PLACE OF STUDY

- Santosh Medical College & Hospital Ghaziabad UP India.

4.2 STUDY DESIGN

- Cross-sectional study, questionnaire-based study

4.3 STUDY POPULATION

- Eastern & Western UP

4.4 STUDY DURATION

- The duration of study 1 year.

4.5 SELECTION CRITERIA-

EXCLUSIONCRITERIA:

- Students pursuing master's in radiological imaging techniques (1^{st} year and 2^{nd} year)
- Radiology professionals

INCLUSIONCRITERIA:

- Students pursuing bachelor's in radiological imaging techniques and diploma.
- Students pursuing courses other than radiological imaging techniques.
- Unwilling participants

4.6 SAMPLING TECHNIQUE

- Convenient Sampling

4.7 SAMPLESIZE - 145

- Calculated by Slovin's formula $n= N / (1+Ne^2)$

4.8 DATA COLLECTION TOOL

- Questionnaire (Closed ended)

4.9 METHOD& MATERIAL

- A questionnaire based cross-sectional study is carried out in teaching institutes & hospitals excluding the candidates who fell under exclusion criteria.
- Verbal consent was obtained from all the students who were included in the study in the field of radiology.
- After reviewing different literatures on the same topic, questions were incorporated and self-structured questionnaire was divided into 5 sections.

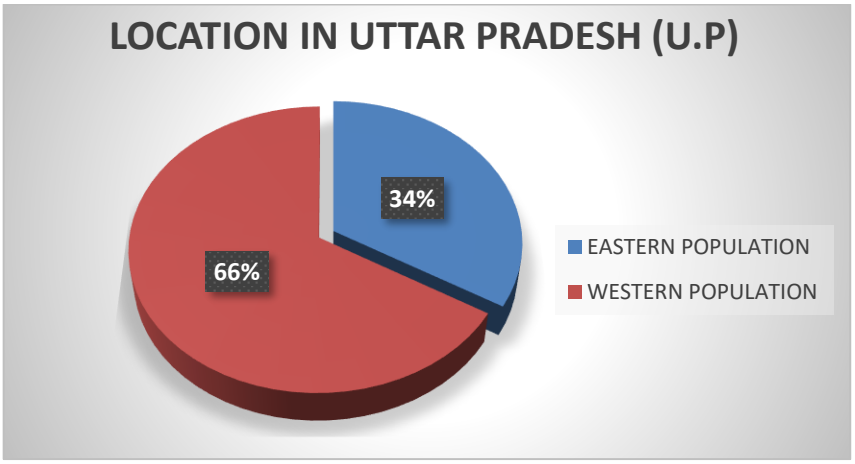
4.10 DATA ANALYSIS

- A questionnaire based cross-sectional study is carried out by creating a google form circulated through e-mail and WhatsApp. The data analysis is done through Microsoft Excel (Microsoft® Excel® 2021 MSO (Version 2407 Build 16.0.17830.20056) 64-bit**)**

CHAPTER – 5

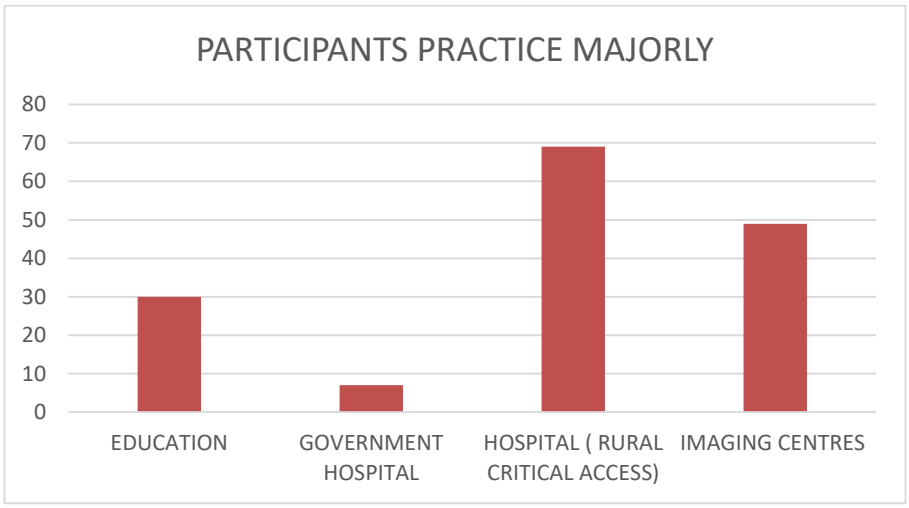
RESULT

In my study the sample size was 145 participants out of which 103 (66%) participants consist of western population and 52 (34%) consists of eastern population as shown in the graph 5.1



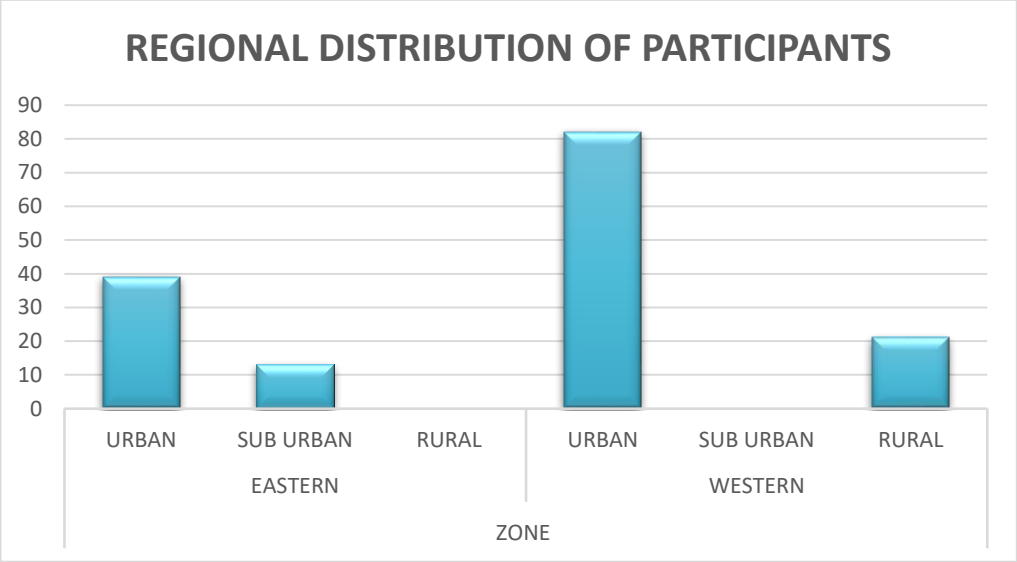
GRAPH 5.1: THE PIE CHART SHOWS REGIONAL DISTRIBUTION OF POPULATION

Most informant work at a hospital 69(44%), 49(32%) work at an imaging centre 30(19%) work in education sector & 7 (5%) work in govt. hospital as shown in graph 5.2 below



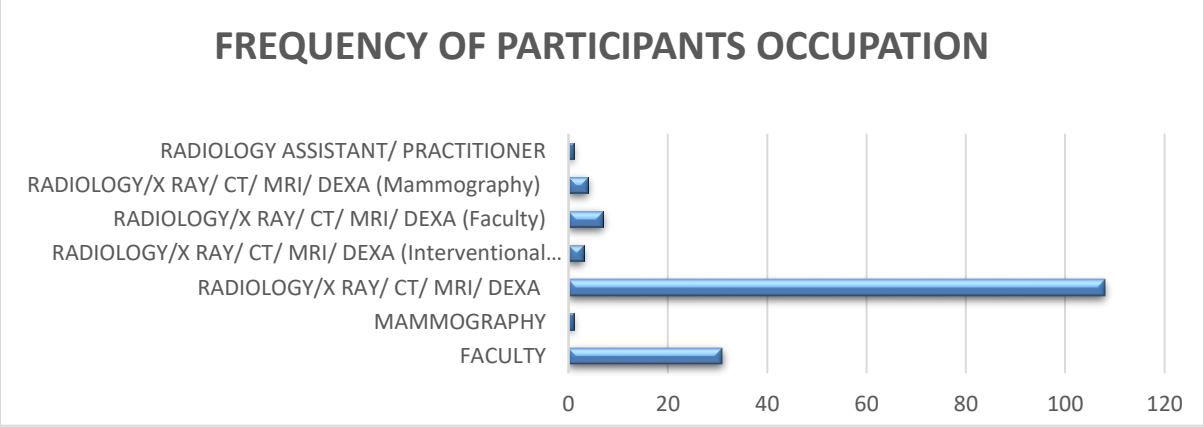
GRAPH 5.2: THE BAR GRAPH REPRESENTS THE PRACTICE SECTORS OF PARTICIPANTS

In eastern population 39 respondents were of urban area and 13 were of suburban area
In western population 82 respondents were of urban area and 12 were of rural area as shown in graph 5.3 below



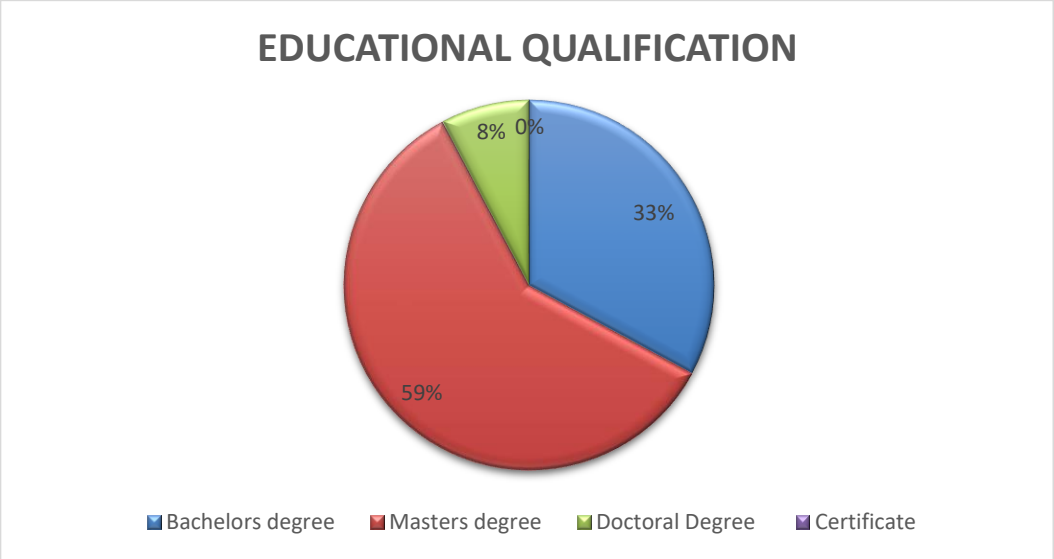
GRAPH 5.3: THE BAR GRAPH REPRESENTS THE REGIONAL DIVISION OF THE PARTICIPANTS

Majorly respondents 108 (70%) were from Radiography (X ray/CT/MRI/DEXA) , 31 (20%) respondents were from education as shown below in graph 5.4



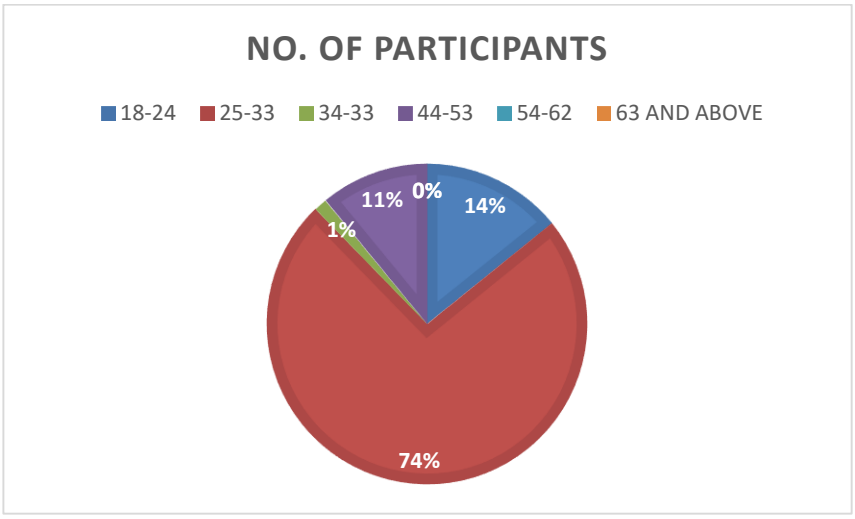
GRAPH 5.4: THE BAR GRAPH SHOWS THE DSICIPLINES OF PARTICIPANTS

Out of all the participants their greatest level of education is listed as a master's degree by 92 (59% of the population), a bachelor's degree by 51 (33%), and a doctorate by 12 (8%) as shown in graph 5.5 below



GRAPH 5.5: THE PIE CHART REPRESENTS THE QUALIFICATION OF PARTICIPANTS

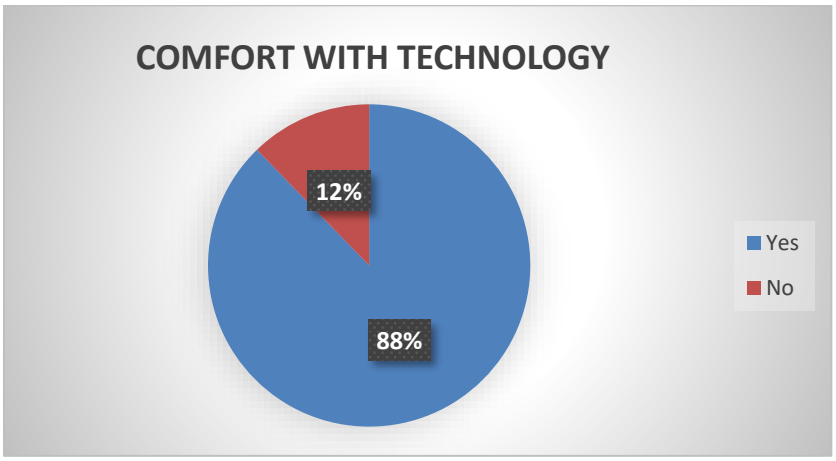
The most common job title among respondent are 131(84%) technologist and 23(12%) education program faculty. Majorly answerers work full-time. 139 (89%), and 16 (11%) additional individuals were working part-time. The mean average age of respondents is 30.13 years as depicted in the pie chart 5.6 below



GRAPH 5.6: THE PIE CHART REPRESENTS THE AGE OF PARTICIPANTS

OVERALL COMFORT

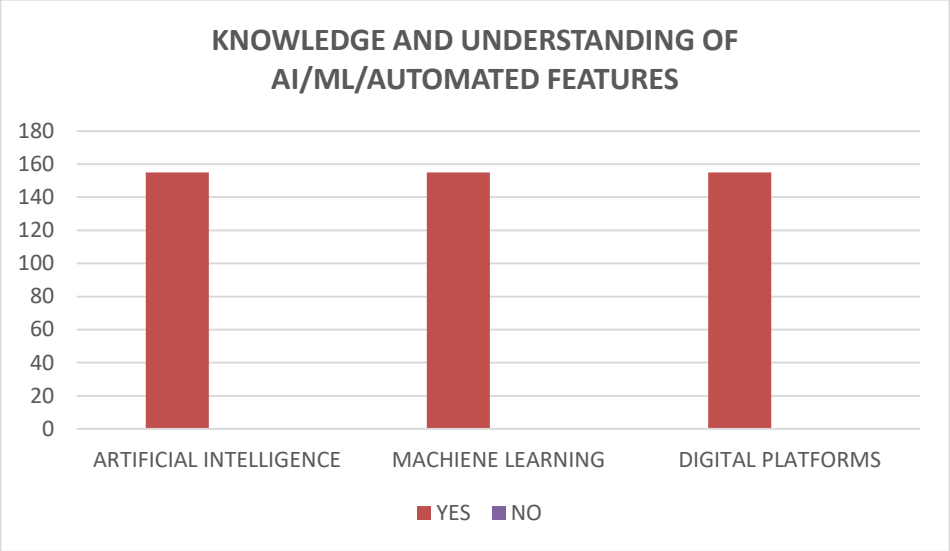
Questions intended to assess respondents' general attitudes about technology as well as their use of it beyond of the radiologic sciences were posed to them. The majority of responders (88%) identify as "tech enthusiasts." as depicted in the pie chart 5.7 below



GRAPH 5.7: THE PIE CHART REPRESENTS THE COMFORT OF PARTICIPANTS WITH TECHNOLOGY

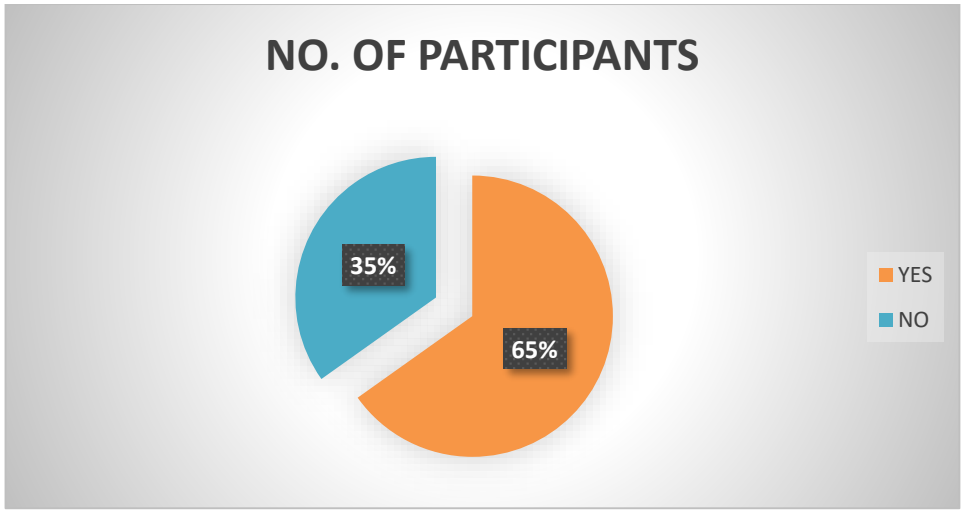
The extent with which respondents utilize a range of widely used technical apps in their daily lives was investigated. In terms of daily engagement, the three most popular activities among respondents include accessing social media sites like Facebook and Instagram, searching the internet using a search engine like Google, and surfing the internet. Regarding their experience with the software used outside of the radiologic sciences, respondents were questioned. For those who consider themselves "advanced users," Microsoft Office Suite is the program they use the most.

All the participants have adequate knowledge about AI because all the participants responded positively for "**AI/ML/digital platforms"** which fulfils the first objective of the research i.e. To assess the knowledge and understanding of AI technologies among radiology professionals as shown in graph 5.8 below



GRAPH 5.8: THE BAR GRAPH REPRESENTS THE FAMILIARITY WITH AI/ML/DIGITAL PLATFORMS OF PARTICIPANTS

When asked how comfortable they were with AI being used in their homes, cars, or other devices, respondents' opinions were divided. In these situations, 133 (85%) feel very comfortable or at ease using AI, while 22 (14%), are ambivalent. The majority of respondents—101, or 65%—state that their department employs automated postprocessing in order to prepare images for submission to PACS, while just 35%—54, or 54—indicate that their department does not as shown in pie chart 5.9 below



GRAPH 5.9: THE PIE CHART REPRESENTS THE USE OF AUTOMATED POSTPROCESSING

The least used AI/ML feature is Automatic positioning. The most used "AI/ML" feature is procedure guidance as shown in the table 5.1 below

	"I use this Feature"	**"This feature is installed, but I don't use it"**	**"I don't know about this feature"**	**"Not applicable"**
Alignment of Isocenterordetector alignment assistance	64	41	29	21
Automatic positioning	51	42	21	41
Procedure guidance	103	18	13	21

TABLE 5.1: THE TABLE REPRESENTS THE USE/AWARENESS OF AI/ML TOOLS IN RADIOGRAPHY

The least used "AI/ML" feature is C-view mapping. The most used "AI/ML" feature is procedure guidance as shown in the table 5.2 below

	"I use this Feature"	**"This feature is installed, but I don't use it"**	**"I don't know about this feature"**	**"Not applicable"**
"Procedure guidance"	106	13	7	29
"Auto positioning"	80	25	1	49
"Self-driving equipment whichmoves out of the way on their own"	73	13	14	55
"C-view mapping"	44	26	8	77

TABLE 5.2: THE TABLE REPRESENTS THE USE/AWARENESS OF AI/ML TOOLS IN COMPUTED TOMOGRAPHY

The least used "AI/ML" feature is Self-driving equipment. The most used "AI/ML" feature is cardiac procedures as shown in the table 5.3 below

	"I use this Feature"	**"This feature is installed, but I don't use it"**	**"I don't know about this feature"**	**"Not applicable"**
Vessel measurement	51	19	48	37
Self-driving equipment that moves out of the way on its own	38	26	47	44
Intervention guidance	63	26	47	38
Vessel detection	71	32	28	18
Automatic positioning	69	27	34	38
CAD for cardiac/brain perfusion	69	27	21	38
Gating for cardiac procedures	70	33	21	31

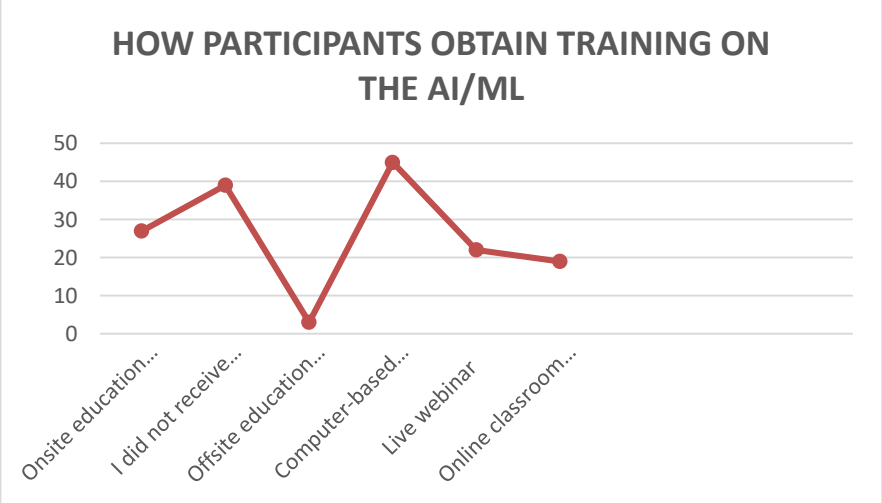
TABLE 5.3: THE TABLE REPRESENTS THE USE/AWARENESS OF AI/ML TOOLS IN INTERVENTIONAL RADIOGRAPHY

The least used “AI/ML” feature is brainwave activity analysis algorithm. The most used “AI/ML” feature is automated image construction as shown in the table 5.4 below

	“I use this Feature”	“This feature is installed, but I don’t use it”	“I don't know about this feature”	“Not applicable”
Automated image reconstruction	104	21	21	9
Tumor abnormality screening software in a surgery/MRI hybrid	68	38	33	16
Disorders of the consciousness brainwave activity analysis algorithm	58	47	20	30

TABLE 5.4: THE TABLE REPRESENTS THE USE/AWARENESS OF AI/ML TOOLS IN MRI

Several respondents believe their equipment's “AI/ML” functions are reliable. As asked about how often they thought these features were working correctly, 20 (12%) said "always." 46 (29%) say "rarely," while 89 (57%) say "most of the time." 47 respondents (18%) said they were trained on AI/ML features through an onsite education facility; 39 respondents (24%) said they were not trained; and 3 respondents said they were trained at a vendor facility. Of the respondents, 45 respondents (29%) said they were instructed on AI/ML features through a computer-based moduleas shown in the graph 5.10 below



GRAPH 5.10: THE LINE GRAPH REPRESENTS THE TRAINING OBTAINED BY PARTICIPANTS ON AI

The responses were skewed toward a higher proportion of respondents perceiving positive or negative effects rather than those considered neutral as listed in the table 5.5 below

Features	Beneficial	Neutral	Negative
Motion artifact recognition	89	28	38
Radiation exposure	87	34	34
Consistency of scans/treatments	96	28	31
Quality of scans/treatments	91	20	44
Workflow	110	0	45
Accuracy of patient positioning	109	1	45
Safety	102	14	39
"Intelligent prioritization" of work	97	20	38
Responsible implementation	103	21	31
AI-supported clinical decisions	99	27	29
Confidential information	96	7	52
Patient interaction	114	7	34
Expense	88	21	46

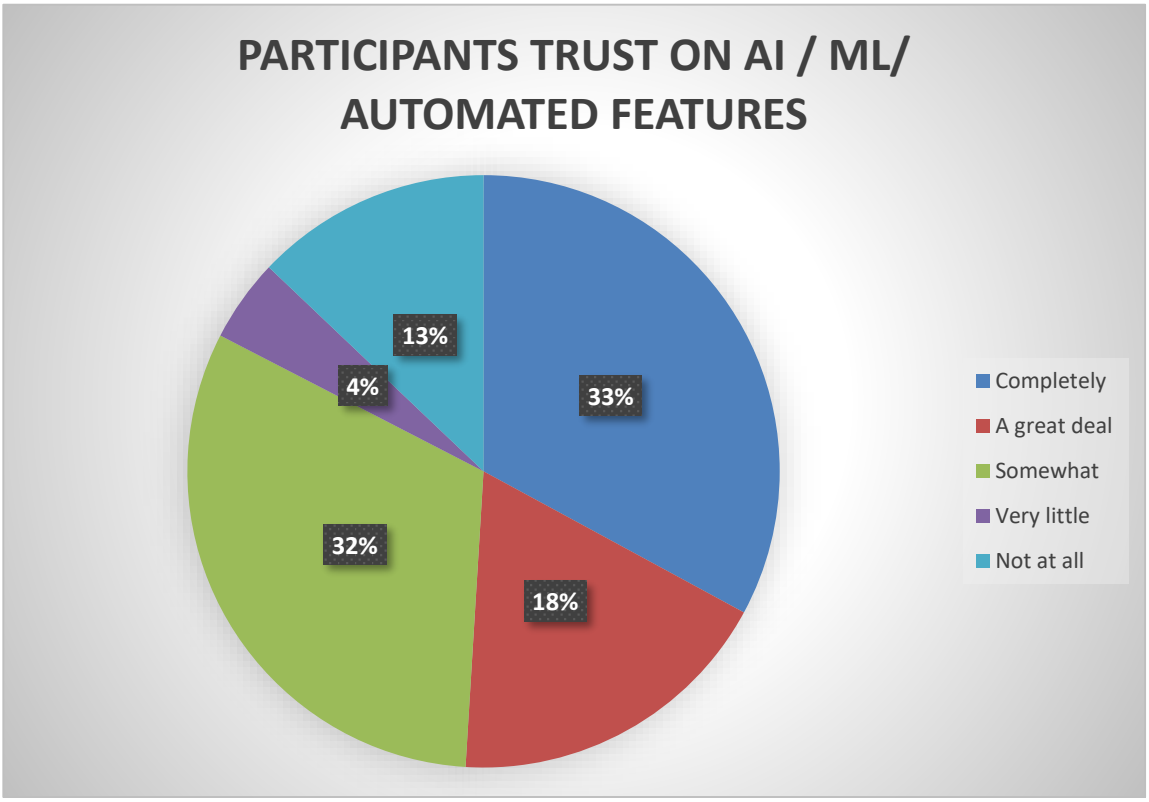
TABLE 5.5: THE TABLE REPRESENTS THE IMPACT ON RADIOGRAPHY FEATURES FROM AI IMPLEMENTATION

A plurality of respondents across all ages expects that opportunities for specialized roles dealing with AI will expand in the profession as shown in the table 5.6 below

Age	Reduce	No Change	Expand
18 to 24	40	34	81
25 to 33	55	16	84
34 to 43	51	48	56
44 to 53	62	44	49
54 to 62	63	35	57
63 or older	70	30	55
All ages	56	30	69

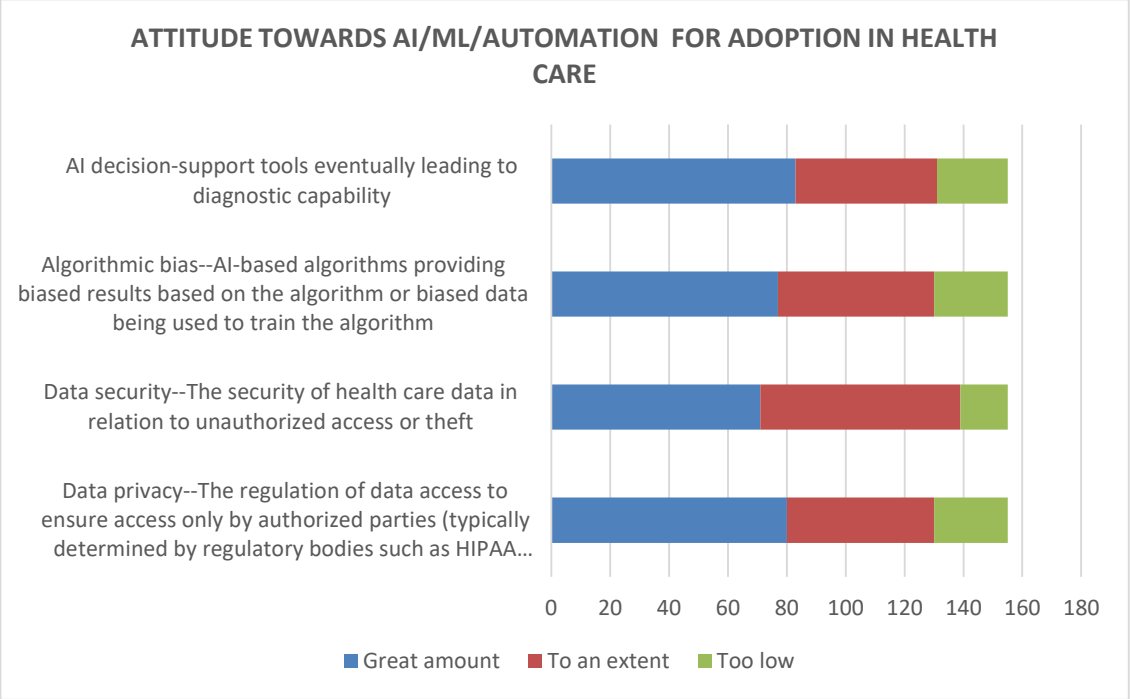
TABLE 5.6: THE TABLE REPRESENTS THE AGE RELEVANCE OF PARTICIPANTS WITH AI ON THEIR JOBS ROLES

Respondents were characterized as cautiously trusting when asked how much they trusted AI/ML features at work; only 33% said they trusted these features totally, while 18% said they trusted them greatly and another 32% said they trusted them slightly. Merely 17.0% of respondents claim to have little to no faith in AI features as depicted in pie chart 5.11 below



GRAPH 5.11: THE PIE CHART REPRESENTS THE RELIABILITY OF PARTCIPANTS ON AI/ML/AUTOMATED FEATURES

The majority of participants think that the adoption of AI in healthcare will be significantly impacted by data security and privacy (51.0% and 45%, respectively). Additionally, 49% of the answerers think algorithmic bias would have a outcome on AI adoption, and 53% feel decision tools for assistance will have a lasting effect as shown in the graph 5.12 below


ATTITUDE TOWARDS AI/ML/AUTOMATION FOR ADOPTION IN HEALTH CARE
AI decision-support tools eventually leading to diagnostic capability
Algorithmic bias--AI-based algorithms providing biased results based on the algorithm or biased data being used to train the algorithm
Data security--The security of health care data in relation to unauthorized access or theft
Data privacy--The regulation of data access to ensure access only by authorized parties (typically determined by regulatory bodies such as HIPAA...
0
20
40
60
80
100
120
140
160
180
Great amount
To an extent
Too low

GRAPH 5.12: THE BAR GRAPH REPRESENTS THE ATTITUDE OF PARTICIPANTS TOWARDS AI/ML ADOPTION

CHAPTER – 6

DISCUSSION

"AI" is the area of computer science centred on developing computers that can carry out tasks that usually require human intelligence. In machine learning (ML), algorithms are trained to carry out tasks by extracting patterns from data instead of explicitly programming them. Given the importance of medical imaging, the use of deep learning algorithms inside machine learning and other associated data science approaches is expected to revolutionize radiology and immediately advance patient care. The field of artificial intelligence is concerned with creating technology that can perform tasks that would typically need human intelligence. AI will surely have a significant impact on radiology in the future. There aren't many studies on AI in the scientific literature. Previously a study was performed to assess medical students' attitude towards artificial intelligence, with a focus of AI in radiology and medicine which showed that 77% agreed that radiology will be improvised by AI and 71% respondents agreed on the need for AI to be included in medical curriculum (D. Pinto dos Santos et al. 2018). Another survey was conducted to assess the knowledge and education about AI among medical students which showed that 62.5% of students know about AI, the main source of learning was internet for them and 85.9% wanted to learn more about AI (Ankush Jindal et al. 2020) [1].

The findings of the research offer valuable insights about the demographics, convictions, and attitudes toward of radiology professionals regarding technology, particularly AI and machine learning (ML) applications. The sample size of 145 participants, with a significant representation of both western (66%) and eastern (34%) populations, enables a nuanced understanding of how cultural and regional factors may influence the acceptance and implementation of technology in the radiologic sciences.

Demographics and Professional Background

The majority of respondents were technologists (84%) working predominantly in hospitals (44%) and imaging centers (32%), suggesting a strong connection between the participants' roles and the application of AI technologies in clinical settings. Notably, a significant portion

of respondents (59%) holds a master's degree, indicating a well-educated workforce, which may contribute to their comfort and familiarity with advanced technologies.

The age of the participants averages at 30.13 years, indicating a relatively young demographic that is likely to be more adaptable to new technologies and innovations. This is crucial, as younger professionals may be more open to integrating AI into their workflows compared to older generations.

Attitudes Towards Technology

The overwhelming majority of respondents (88%) identified as individuals who enjoy technology, which bodes well for the acceptance of AI and ML applications in their professional practices. This positive attitude was further reflected in their daily engagement with common technological activities, such as internet browsing and social media usage. Such familiarity with technology suggests that these professionals may be more receptive to adopting AI tools in their work environments.

The study also revealed a high level of self-reported knowledge regarding AI technologies, fulfilling the study's first objective. This indicates that radiology professionals are not only aware of AI but are also engaging with it in a meaningful way, it is crucial for these tools to be effectively employed in clinical practice.

Comfort and Trust in AI

85% of respondents stated that they were either safe or highly at ease utilizing AI in personal devices and settings, indicating that many professionals are prepared to use AI in their work environments. However, trust in AI features at work appeared to be more cautious. Only 33% indicated complete trust in these features, with a substantial proportion (49%) acknowledging potential concerns regarding data privacy and security. This hesitancy underscores the need for ongoing education and transparent communication regarding the reliability and safety of AI technologies in healthcare.

Utilization of AI Features

The data reveal varied usage patterns of AI/ML features in the workplace. The most commonly utilized features, such as procedure guidance, indicate a preference for tools that enhance operational efficiency and assist in decision-making. In contrast, the least used features, like automatic positioning and brainwave activity analysis, suggest potential areas for development or further training. The disparity in utilization highlights the importance of tailored training programs that cater to the specific needs and technological literacy of different departments.

Training and Education

The study highlights a critical area for improvement regarding training and education on AI technologies. While many respondents have received training through various formats, a significant number (24%) reported no training at all. This gap indicates a need for enhanced educational initiatives to ensure that all professionals feel confident and capable in using AI technologies effectively. The varying formats of training received suggest that a hybrid approach, combining online and onsite training, could be beneficial.

Perceived Effects of AI Implementation

Respondents were generally optimistic about the future role of AI in radiology, with a plurality expecting that specialized roles related to AI will expand. This optimism is essential for fostering an innovative environment that embraces technological advancements. However, concerns about algorithmic bias and decision support tools also emerged, emphasizing the need for ongoing evaluation and refinement of AI applications to ensure equitable and effective outcomes.

CHAPTER-7

CONCLUSION

In conclusion, the study reveals a generally positive attitude among radiology professionals towards technology, with a specific enthusiasm for AI and ML applications. While there is a strong foundation of knowledge and a willingness to adopt these technologies, areas for improvement remain in training, trust, and addressing ethical concerns. As the field of radiology continues to evolve with technological advancements, it is imperative to prioritize education, transparency, and ethical factors that will help “AI” be implemented effectively into clinical practice. Future research could explore longitudinal changes in attitudes and usage patterns as AI technologies continue to develop and become more widespread.

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LETTER OF ETHICAL CLEARANCE FOR DISSERTATION FROM REGISTRAR OFFICE

SANTOSH
Deemed to be University
(Established u/s 3 of the UGC Act, 1956)

F. No. SU/R/2024/1344[48] Dated: 17.05.2024

Subject: Grant of Ethical Clearance for **Dissertation Protocol** Topic **"To Evaluate and Assess the Perspective of Radiology Professional towards Artificial Intelligence",** submitted by **PRACHI SINGH,** student of M.Sc Medical Imaging Technology, 2022 Batch.

*****

With reference to the request for grant of Ethical Clearance for the Dissertation Protocol entitled **"To Evaluate and Assess the Perspective of Radiology Professional towards Artificial Intelligence"**, **PRACHI SINGH** is informed that the **Dissertation Protocol** submitted by him/her was considered by the **Screening Committee** of the **Allied Health Sciences** in its meetings held on 07.02.2024 and 29.02.2024. The recommendations of the **Screening Committee** were considered in detail by the **Institutional Ethics Committee** in its meeting held on **15.05.2024** and the same was **approved** by the **Ethics Committee** of the **Santosh Deemed to be University, Ghaziabad, Delhi NCR.**

He /She is informed accordingly for further necessary action.

17/5/24

[Dr. EZHILRAJAN. K]
REGISTRAR

REGISTRAR

PRACHI SINGH
M.Sc Medical Imaging Technology.

Copy to:

1. The Vice Chancellor
2. The Dean – Academics
3. The Dean, SMC&H
4. The Dean – Research
5. The Director - IQAC
6. HOD/ Course In-charge of the concerned Department.

PLAGIARISM CERTIFICATE

TO EVALUATE AND ASSESS THE PERSPECTIVE OF RADIOLOGY PROFESSIONAL TOWARDS ARTIFICIAL INTELLIGENCE- THE FUTURE OF RADIOLOGY

ORIGINALITY REPORT

1 %
SIMILARITY INDEX

PRIMARY SOURCES

1	www.asrt.org Internet	62 words — 1%
2	pdfs.semanticscholar.org Internet	14 words — < 1%

EXCLUDE QUOTES	ON	EXCLUDE SOURCES	< 5 WORDS
EXCLUDE BIBLIOGRAPHY	ON	EXCLUDE MATCHES	< 14 WORDS

MASTER CHART

Tasks	Tasks Duration	Start Date	End date	Aug-Sep	Oct-Nov	Dec-Jan	Feb-Mar	Apr-May	Jun-Jul	Aug-Sep
Preparation of Thesis Proposal	21	15-7-23	5/8/2023							
Presentation of Thesis Proposal	25	5/8/2023	30/8/2023							
Preparation & Submission Thesis Application in Ethics Committee	41	30/8/2023	10/10/2023							
Review of Literature	45	10/10/2023	7/1/2024							
Data Collection	153	17-2-24	24-5-24							
Data Analysis	5	24-6-24	31-6-24							
Finding & Recommendations	10	31-7-24	10/8/2024							
Report Writing	25	31-7-24	30-8-24							
Submission of Thesis	5	30-8-24	4/9/2024							
Presentation of Thesis	0									

APPENDIX – I

QUESTIONNAIRE

SURVEY TO ASSESS THEPERSPECTIVE OF RADIOLOGY PROFESSIONAL TOWARDS ARTIFICIAL INTELLIGENCE

AI (ARTIFICIAL INTELLIGENCE)
ML (MACHINE LEARNING)

* Indicates required question

1. Name *

2. Email Id *

3. In which disciplines do you actively work ? (Please check all that apply) *

Tick all that apply.

- [ ] Radiography (X RAY/CT/MRI/DEXA)
- [ ] Mammography
- [ ] Interventional radiography
- [ ] Nuclear medicine Technology
- [ ] Imaging Informatics/ PACS Administrator
- [ ] Fusion (PET-CT/SPECT)
- [ ] Radiology Assistant/ Practitioner Faculty
- [ ]

4. In which region of Uttar Pradesh is your workplace located *

Mark only one oval.

- ◯ Eastern UP
- ◯ Western UP

5. In which employment setting do you practice most of the time? *

Tick all that apply.

- [ ] Imaging center
- [ ] Education
- [ ] Hospital (Rural Critical Access)
- [ ] Government hospital Mobile
- [ ] Unit

6. What is the location of your facility?

Tick all that apply.

- [ ] Urban
- [ ] Suburban
- [ ] Rural

7. Which of the following best describes your job title? *

Tick all that apply.

- [ ] Technologist
- [ ] Administrator/manager
- [ ] Education program faculty
- [ ] Commercial representative (e.g., sales, applications specialist)

8. What is your employment status? *

Tick all that apply.

- [ ] Full time (35 hours/week or more)
- [ ] Part time (less than 35 hours/week)
- [ ] I am not currently employed

9. What is the highest level of education you have earned? *

Tick all that apply.

- [ ] Bachelor's degree
- [ ] Master's degree
- [ ]
- [ ]

Doctoral degree (including medical)

Certi cate

10. Age *

Tick all that apply.

- [ ] 18 - 24
- [ ] 25 - 33
- [ ] 34 - 43
- [ ] 44 - 53
- [ ] 54 - 62
- [ ] 63 or older

OVERALL COMFORT WITH TECHNOLOGY

11. Would you describe yourself as someone who enjoys technology? *

Tick all that apply.

- [ ] Yes
- [ ] No

12. On average, how frequently do you do each of the following? *

Markonlyoneovalperrow.

	Afew times per year	Afew times per month	Afew times per week	Daily
Browsethe internet	◯	◯	◯	◯
Useaninternet searchengine (Google,Yahoo)	◯	◯	◯	◯
Usesocial media (Facebook, Twitter,	◯	◯	◯	◯

Instagram)				
Shoponline (e.g.,Amazon, eBay)				
Bank/paybills online				
Useyour smartphone fornavigation				
Usea streaming service(e.g., Netix,Spotify)				
Playgameson aconsoleor PC				
Playgameson your smartphone				
Usea smartwatch				

13. How would you rate your experience in the following areas? *

Mark only one oval per row.

	No experience	Beginner	Intermediate user	Advanced user
Microsoft Office Suite (e.g., Word, Excel, PowerPoint)				
Financial/accounting software				
Mathematical/statistical analysis software				
Programming (e.g., Java, C, Python)				
Database management (e.g., SQL)				
Authoring tools (e.g., Captivate, Articulate				
Animation software (e.g., Vyond, Autodesk Maya)				
Adobe Creative Cloud (e.g., Photoshop, Illustrator, Audition)				

GENERAL UNDERSTANDING OF AI AND ML

14. Artificial Intelligence (AI): Human intelligence exhibited by machines; the * science of designing computer systems to perform tasks that require human intelligence, including visual perception, speech recognition and decisionmaking.

Are you familiar with this concept?

Tick all that apply.

- [ ] Yes
- [ ] No

*

15. Machine Learning (ML): Approach to achieve artificial intelligence; a type of artificial intelligence that provides computers with the ability to learn without being programmed. Using a set of algorithms, the computer reviews large data sets, looks for patterns and makes predictions that improve with increased exposure to data.

Are you familiar with this concept?

Tick all that apply.

- [ ] Yes
- [ ] No

16. Are you aware that many everyday devices and applications such as Siri, * Alexa, Google Assistant, Facebook and Netflix already use AI, for example, by making recommendations based on data about user preferences?

Tick all that apply.

- [ ] Yes
- [ ] No

17. How comfortable would you be with AI being implemented in your home, car or * devices?

Tick all that apply.

- [ ] Very comfortable
- [ ] Comfortable
- [ ] Neutral
- [ ] Uncomfortable
- [ ] Very uncomfortable

USE OF AI/ML IN THE RADIOLOGIC SCIENCES

18. Does your department use automated post processing of images before they are sent to PACS?

Mark only one oval.

- ◯ Yes
- ◯ No

*

19. For the radiography equipment you use, please indicate your use/awareness of * the following AI/ML/automated features

Markonlyoneovalperrow.

	Iuse this	Installed, butdon't useit	Idon't know	Not Applicable
Isocenter alignment/detector alignment assistance				
Automatic positioning				
Procedure guidance				

20. For the computed tomography equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

Markonlyoneovalperrow.

	Iuse this	Installed, butdon't useit	Idon't know	Not applicable
Procedure guidance				
Auto positioning				
Self-driving equipment that moves out of the way on its own				
C-view mapping				

*

21. For the interventional equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

Markonlyoneovalperrow.

	Iuse this	Installed, butdon't useit	Idon't know	Not applicable
Vessel measurement	◯	◯	◯	◯
Self-driving equipment that moves out of the wayonits own	◯	◯	◯	◯
Intervention guidance	◯	◯	◯	◯
Vessel detection	◯	◯	◯	◯
Auto positioning	◯	◯	◯	◯
CADfor cardiac/brain perfusion	◯	◯	◯	◯
Gatingfor cardiac procedures	◯	◯	◯	◯

22. For the magnetic resonance imaging equipment you use, please indicate your use/awareness of the following AI/ML/automated features:

Markonlyoneovalperrow.

	Iuse this	installed, butdon't useit	Idon't know	Not applicable
Automated image reconstruction	◯	◯	◯	◯
Tumor abnormality screening software in a surgery/MRI hybrid	◯	◯	◯	◯

*

Disordersof consciousness				

23. Thinking about the AI/ML/automated features on the equipment you use, how often do you feel those features are operating correctly? *

Tick all that apply.

- [ ] Always
- [ ] Most of the time
- [ ] Rarely
- [ ] Never

24. How did you obtain training on the AI/ML/automated features that are on your equipment? (Please check all that apply) *

Tick all that apply.

- [ ] Onsite education at your facility
- [ ] I did not receive training
- [ ] Offsite education at a vendor facility
- [ ] Computer-based module
- [ ] Live webinar
- [ ] Online classroom education

*

EFFECTS OF AI/ML

25. For the following considerations, please indicate whether you think AI/ML/automated features will be beneficial, neutral or negative: *
Mark only one oval per row.

	Beneficial	Negative	Neutral
Motion artifact recognition	◯	◯	◯
Radiation exposure	◯	◯	◯
Consistency of scans/treatments	◯	◯	◯
Quality of scans/treatments	◯	◯	◯
Workflow	◯	◯	◯
Accuracy of patient positioning	◯	◯	◯
Safety	◯	◯	◯
"Intelligent prioritization" of work	◯	◯	◯
Responsible implementation	◯	◯	◯
AI-supported clinical decisions	◯	◯	◯
Confidential information	◯	◯	◯
Patient interaction	◯	◯	◯
Expense	◯	◯	◯

*

26. How do you think AI/ML/automated features will affect the age group, * specialized roles dealing with AI/ML/automated features?

Markonlyoneovalperrow.

	Reduce	No change	Expand
18to 24			
25to 33			
34to 43			
44to 53			
54to 62			
63or older			
All ages			

27. In general, how much do you trust AI/ML/automated features at work? *

Tick all that apply.

- [ ] Completely
- [ ] Great amount
- [ ] To an extent
- [ ] Too low
- [ ] Not at all

28. How much do you believe the following considerations affect the adoption * of AI/ML/automation in health care?

*

Markonlyoneovalperrow.

	Great amount	Toan extent	Too low
Data privacy			
Data security			
Algorithmic bias			
AIdecision			

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